भारतीय मानक
Indian Standard

IS 16239 : 2021

पॉलियूरिथेन चमकरहित
(दो पैक) — विशिष्टि

Polyurethane Matt Finish
(Two Pack) — Specification

ICS 87.040

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Paints, Varnishes and Related Products Sectional Committee, CHD 20

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Paints, Varnishes and Related Products Sectional Committee had been approved by the Chemical Division Council.

Polyurethane coatings are known in the industry as some of the toughest and most useful coatings available. Polyurethane coatings are versatile and have wide-ranging applications as commercial and industrial protective coatings as well as for use as decorative coatings on walls, floors and other surfaces. The coatings can be designed to be glossy or matt depending on the requirement.

An Indian Standard IS 13213 already exists for Full Gloss PU Finish. However, there is no Indian Standard for PU Matt Finish and hence this standard has been designed particularly for applications requiring good exterior durability and the desired degree of aesthetics. Applications include grills, window sills, etc in commercial transport vehicles.

The standard covers the necessary parameters to which the liquid paint and the paint film should adhere to. The standard has been derived mainly from IS 13213 : 1991 'Polyurethane full gloss enamel (two pack) and IS 8662 : 2004 'Enamel, synthetic exterior: a) Undercoating b) Finishing', for railway coaches with suitable modifications, such as gloss value, finish etc in line with the requirements of an exterior PU matt finish. It should be noted that the polyurethane coatings present two-fold hazards such as toxicity and fire. Hence, necessary precautions should be taken in handling and painting with these materials (*see* Annex G).

This material is intended for use in decoration and protection of areas, such as grills and window sills of exterior of railway coaches, automotives etc. Presence of lead compounds in such product may cause exposure of children and adult by way of physical contact, swallowing of chips, inhalation of dust etc, leading to toxic effect. Therefore, the Committee responsible for formulation of this standard felt necessary to impose restriction on the presence of lead in this product though it is intended to use for industrial purpose. The Committee also kept in view of relevance of lead restriction with respect to application condition and service life of the paint and observed that the product is of such composition that it would be easy to incorporate lead restriction without creating any negative impact. In this standard maximum permissible content of lead has been prescribed as 90 ppm. Further majority of consumers are not aware of the adverse consequence of lead toxicity and its long-term implications, therefore, along with lead restriction, a suitable cautionary notice has been included in the marking clause.

The Committee composition responsible for formulation of this standard is given in Annex H.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

POLYURETHANE MATT FINISH (TWO PACK) — SPECIFICATION

1 SCOPE

1.1 This standard prescribes requirements and methods of sampling and test of two pack matt finish polyurethane intended to be used for decoration and protection of areas such as grills, window sills of exterior of railway coaches, automotives, diesel and electric locomotive against atmospheric corrosion.

1.1.1 It is primarily suitable for application by spraying. It may also be applied by brush for touching up small areas.

1.1.2 The material is intended to be used as a top coat in painting system for the protection of exterior of railway coaches, etc, involving wet and damp areas, high humidity, and coastal, marine and industrial fall out. Polyurethane paints shall be suitable for use in those exterior applications where it is desirable to retain aesthetics for long periods of time in addition to providing excellent chemical and corrosion resistance.

2 REFERENCES

The standards listed in Annex A contains provisions which though reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definition given in IS 1303 and the following shall apply.

3.1 Paint — The mixture of the two components in the proportion recommended by the manufacturer.

3.2 Component — Each of the two parts of the paint which when mixed together, form a pigmented polyurethane paint.

4 REQUIREMENTS

4.1 Composition

The paint shall consist essentially of two components, base and hardener or catalyst solution to be mixed in such simple proportion preferably by volume to satisfy all the requirements of this standard.

4.1.1 The base shall consist of:

a) an appropriate acrylic polyol, and
b) pigments, solvents and additives.

4.1.2 Hardener or catalyst solution shall consist of:

a) an aliphatic polyisocyanate, and
b) solvents and additive.

NOTE — To determine whether the polyisocyanate is aliphatic or aromatic in nature, the test shall be carried out as prescribed in Annex B.

4.1.3 The mixture of base and hardener shall be allowed to mature for 20 min at 27 ± 2 °C. The mixture must be consumed within 4 h after mixing.

4.2 Lead Restriction

4.2.1 The material shall not contain lead or compounds of lead or mixtures of both, as metallic lead more than 90 ppm, when tested for restriction from lead in accordance with IS 101 (Part 8/Sec 5).

4.3 The material shall also comply with the requirements given in Table 1.

5 PACKING AND MARKING

5.1 Packing

The material shall be packed in dual container. Unless otherwise agreed to between the purchaser and the supplier, the material shall be packed in metal containers conforming to IS 1407 and IS 2552. It shall ensure that the quality does not deteriorate during storage. The packing is subject to the provisions of the law in force in the country at that time.

5.1.1 Each component as delivered shall be free of gel, coarse particles, skins, foreign matter and sediments. Any sediment formed in the container shall be mixed thoroughly, preferably with power driven stirrer to form homogeneous paint. However, rise in temperature shall not be more than 5 °C.

5.2 Marking

5.2.1 Each container shall be marked with the following:

a) Name of the material with component’s name;
b) Indication of the source of manufacture;
c) Volume of the material;

Table 1 Requirements for Matt Polyurethane Finish (Two Pack)

(*Clauses* 4.3 *and* 7.1)

Sl No.	**Characteristics**	**Requirements**	**Methods of Test, Ref to**	
			IS 101	Annex
(1)	(2)	(3)	(4)	(5)
i)	Consistency	Smooth, uniform and suitable for spray applications	—	C
ii)	Drying time, h, *Max*		(Part 3/Sec 1)	—
	a) Surface dry	2		
	b) Hard dry	8		
	c) Hard dry, 70 °C	1/2 h with 15 min flash off time		
iii)	Finish	Smooth and matt	(Part 3/Sec 4)	—
iv)	Colour	Close match to the colour specified in IS 5 or to an agreed colour	(Part 4/Sec 2)	—
v)	Dry film thickness	35 – 45 microns	**6.2.2.1** of (Part 3/Sec 2)	—
vi)	Gloss 60° [1], *Max*	20	(Part 4/Sec 4)	—
vii)	Volume solids percent, *Min*[2]	40	(Part 8/Sec 6)	—
viii)	Flexibility and adhesion			
	a) Scratch hardness (Load 1 500 g)	No such scratch as to show the bare metal	Cl **3** of (Part 5/Sec 2)	—
	b) Bend test with 6.25 mm dia mandrel in type 1 apparatus	No visible damage or detachment after	Cl **2** of (Part 5/Sec 2)	—
ix)	Fineness of grind, *Max*[1]	25 microns	(Part 3/Sec 5)	—
x)	Pot life, h, *Min*	4	—	D
xi)	Mass, kg/10 litres, *Min*	9.5	(Part l/Sec 7)	—
xii)	Flash point, base and hardner each	Not below 25 °C	(Part l/Sec 6)	—
xiii)	Accelerated tests		—	E
	(Test for chemical resistance)			
	a) Resistance to acid	To pass the test		
	b) Resistance to alkali	To pass the test		
	c) Resistance to oil	To pass the test		
	d) Resistance to solvents – Ethanol, acetone and xylene	To pass the test		
xiv)	Durability test	Parameter	Rating	F
	a) Normal out-door exposure test			
	b) Accelerated weathering test	Chalking	9-10	
		Checking	10	
		Cracking	10	
		Flaking	10	
		Spotting	10	
		Blistering	10	
		Colour change	7-8	
	Gloss, *Min*	There shall be no appreciable change in the matt appearance and film integrity. On the scale 1 (Worst)-10 (Best), rating shall be 7		

[1] Test Panels shall be kept at 70 °C for hard drying or as agreed between supplier and customer.

[2] Substitute 90° for 105° as drying temperature in IS 101 (Part 8/Sec 6) while carrying out this test.

d) Month and year of manufacture;
e) Batch number or lot number in code or otherwise;
f) Colour/shade of the material;
g) Lead content, *Max*;
h) Mixing proportion recommended for use;
j) Other instructions for safe handling and use of the material; and
k) A cautionary note as below:
    1) Keep out of reach of children.
    2) Dried film of this paint may be harmful if eaten or chewed.
    3) This product may be harmful if swallowed or inhaled.

5.2.2 The containers may also be marked with the Standard mark. The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

5.3 Other details of packing and marking shall be in accordance with the instructions given by the purchaser.

6 SAMPLING AND PREPARATION OF TEST SAMPLES

6.1 Sampling

Representative samples of the material shall be drawn as per **6** of IS 101(Part 1/Sec 1).

6.2 Preparation of Paints for Test and Methods of Application

6.2.1 *Apparatus*

6.2.1.1 A suitable high speed stirrer.

6.2.1.2 *Spray gun*

A spray gun with adjustable nozzle aperture and air pressure suitable for spraying paints.

6.2.1.3 *A suitable brush*

6.2.2 *Procedure for Preparation*

The two components of polyurethane matt finish shall be thoroughly mixed in the ratio recommended by the manufacturer of the paint and thinned if required, with appropriate thinners before conducting the test or tests. During mixing of two components in large quantities, the mixing may be done using a high speed stirrer (*see* **6.2.1.1**) and the rise in temperature shall not be more than 5 °C. The paint so prepared (*see* **6.2.2**) is now ready for application on panels which are to be subjected to different tests.

6.2.3 *Application of Paint*

Application of paints so prepared (*see* **6.2.2**) on panels shall be done either by brushing with a suitable paint brush (*see* **6.2.1.3)** or by using suitable spraying apparatus (*see* **6.2.1.2)**. The spray gun shall be thoroughly cleaned before use. Correct size of nozzle and air-cap shall be fitted to it. The air pressure shall be adjusted in accordance with the viscosity of the material to be sprayed. The application process shall be performed under controlled atmosphere, such as in paint booth, to avoid contamination of panels from dust, overspray etc. All safety precautions need to be adopted by the painter during the preparation and application stage.

6.3 Preparation of Test Panels

6.3.1 *Preparation of Panels for Drying Time, Dry Film Thickness Test*

Prepare mild steel panel of sizes 150 mm × 100 mm × 1.25 mm as prescribed in **2** of IS 101 (Part 1/Sec 3). Apply the paint as prepared in **6.2.2** uniformly on each side of the panel by air spraying to give a dry film thickness 35 to 45 microns. The film thickness shall be determined by the method prescribed in **6.2.2.1** of IS 101 (Part 3/Sec 2). Prepared test panel then subjected to the test as specified in IS 101 (Part 3/Sec 1) as soon as possible.

6.3.2 *For Flexibility and Adhesion Test*

For both bend test and scratch hardness test prepare burnished tin plate panels of sizes 100 mm × 50 mm × 0.3 mm by the method prescribed in **3** of IS 101 (Part 1/Sec 3). Apply paint as prepared in **6.2.2** by air spraying on the panels as to give a uniform and evenly coated dry film thickness of 30 microns minimum. Allow some time for the coat to dry and measure the paint thickness by the method prescribed in **6.2.2.1** of IS 101 (Part 3/Sec 2). The coated test panels shall be dried for 48 h and then shall be conditioned at a temperature of 27 ± 2 °C and relative humidity of 65 ± 5 percent for a minimum period of 16 h. Prepared test panels the subjected to the test as prescribed in **2** and **3** of IS 101 (Part 5/Sec 2) for bend test and scratch hardness test respectively.

6.3.3 *For Accelerated Tests*

Prepare mild steel panel of sizes 150 mm × 100 mm × 1.25 mm as prescribed in **2** of IS 101 (Part 1/Sec 3). The air drying of the panels shall be done at room temperature and at a relative humidity of not more than 70 percent. The surface of the test panels shall be prepared by following either method A or method B as describe hereunder, taking care that total dry film thickness of the complete system shall be between 105 and 115 microns by following method A and between 75 and 85 microns when follow method B.

6.3.3.1 *Method A*

a) Apply uniformly one coat of epoxy zinc phosphate primer (two-pack) (*see* IS 13238) by spraying at minimum 35 microns dry film thickness and allow to dry for at least 6 h and not more than 24 h.

b) Rub down lightly with waterproof emery paper No. 400, wipe off the surface using a piece of clean and dry soft cloth and then apply uniformly one/two coat of epoxy surfacer (two-pack) (*see* IS 13239) at minimum 35 microns dry film thickness by spraying and allow to dry for at least 6 h and not more than 24 h.

c) Rub down, wet, with waterproof emery paper No. 400, wipe off the surface using a piece of clean and dry soft cloth and then apply uniformly two coats of polyurethane matt finish (two-pack) at a dry film thickness of 35 to 45 microns by spraying and give flash off of 15 min. The panel(s) shall be dried at a temperature of 70 ± 5 °C for 30 min followed by conditioning for 24 h at a temperature of 27 ± 2 °C and RH 65 ± 5 percent prior to commencement of accelerated testing, alternatively the panel(s) shall be dried for 7 days at temperature of 27 ± 2 °C and RH 65 ± 5 percent.

6.3.3.2 *Method B*

a) Apply uniformly one coat of etch primer (*see* IS 5666) at minimum 5 to 10 microns dry film thickness and give flash off of 5 to 10 min.

b) Rub down lightly with waterproof emery paper No. 400, wipe off the surface using a piece of clean and dry soft cloth and then apply uniformly two coats of PU primer surfacer (*see* IS 13799) at minimum 35 microns dry film thickness by spraying and give flash off of 10 minutes before curing. The panel(s) shall be cured at 65 ± 5 °C for 30 min or at temperature 27 ± 2 °C and RH 65 ± 5 percent for 24 h.

c) Rub down lightly with emery paper No. 400 and wipe off the dust with isopropyl alcohol or petroleum hydrocarbon solvents or xylene. Then apply uniformly two coats of polyurethane matt finish (two-pack) at 35 to 45 microns dry film thickness by spraying and give flash-off of 15 min. The panel(s) shall be dried at 70 ± 5 °C for 30 min followed by conditioning for 24 h at a temperature of 27 ± 2 °C and RH 65 ± 5 percent prior to commencement of accelerated testing or for 7 days at a temperature of 27 ± 2 °C and RH 65 ± 5 percent.

6.4 Criteria for Conformity

6.4.1 Drying time and dry film thickness shall be tested on at least 2 samples taken from 2 different containers selected as per **7.1**. For lot size above 1 000 kg, this shall be minimum 3. For the rest characteristics, tests shall be conducted on one composite sample prepared from individual samples taken from different containers in the sample.

6.4.2 There shall be no failure in respect of any test if the lot is to be considered conforming to the requirements of this standard.

7 TEST METHODS

7.1 Tests shall be conducted as prescribed in **4.1, 4.2** and the test methods referred in co1 **4** and **5** of Table 1.

7.2 Quality of Reagents

Unless specified otherwise, pure chemicals and distilled water (*see* IS 1070) shall be employed.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
5 : 2007	Colours for ready mixed paints and enamels (*sixth revision*)
101	Methods of sampling and test for paints varnishes and related products:
(Part 1)	Test on liquid paints (general and physical),
(Sec 1) : 1986	Sampling (*third revision*)
(Sec 3) : 1986	Preparation of panels (*third revision*)
(Sec 5) : 1989	Consistency (*third revision*)
(Sec 6) : 1987	Flash point (*third revision*)
(Sec 7) : 1987	Mass per 10 litre (*third revision*)
(Part 3)	Tests on paint film formation,
(Sec 1) : 1986	Drying time (*third revision*)
(Sec 2) : 1989	Film thickness (*third revision*)
(Sec 4) : 1987	Finish (*third revision*)
(Sec 5) : 1987	Fineness of grind (*third revision*)
(Part 4)	Optical tests on paint films,
(Sec 2) : 1989	Colour (*third revision*)
(Sec 4) : 1988	Gloss (*third revision*)
(Part 5)	Mechanical test on paint films,
(Sec 2) : 1988	Flexibility and adhesion tests (*third revision*)
(Part 8)	Tests for pigments and other solids,
(Sec 5) : 1993	Lead restriction test (*third revision*)
(Sec 6) : 1993	Volume solids
170 : 2004	Acetone — Specification (*fourth revision*)
266 : 1993	Sulphuric acid (*third revision*)
1017 : 1983	Shamois leather (*second revision*)
1070 : 1992	Reagent grade water (*third revision*)
1303 : 1983	Glossary of terms relating to paints (*second revision*)
1407 : 1980	Round paint tins (*second revision*)
2552 : 1989	Steel drums (galvanized and ungalvanized) (*third revision*)
5666 : 1970	Etch primer
6831 : 1992	Caustic potash (*second revision*)
8662 : 2004	Enamel synthetic, exterior (a) under coating (b) finishing for railway coaches
13213 : 1991	Polyurethane full gloss enamel (two pack)
13238 : 1991	Epoxy based zinc phosphate primer (two pack)
13239 : 1991	Epoxy surfacer (two pack)
13799 : 1993	Polyurethane surfacer
15464 : 2004	Anhydrous ethanol for use in automotive fuel — Specification

ANNEX B

(*Clause* 4.1.2)

METHOD OF IDENTIFYING AROMATIC AND ALIPHATIC ISOCYANATES

B-0 GENERAL

Aliphatic polyisocyanates show no coloration while aromatic polyisocyanates show a light brown to a dark reddish brown coloration with hydrogen peroxide.

B-1 REAGENTS

B-1.1 Acetone — *See* IS 170.

B-1.2 Three percent hydrogen peroxide solution in acetone.

B-2 PROCEDURE

B-2.1 Prepare an approximately 40-50 percent solution of the polyisocyanate in acetone. To 50 ml of this solution, stir 1 ml of 3 percent hydrogen peroxide solution. Allow it to stand for 5-10 min.

B-2.2 The development of any light brown to a dark reddish brown colour indicates aromatic polyisocyanates. No colour indicates aliphatic polyisocyanates.

ANNEX C

[*Table* 1, *Sl No.* (i) (a)]

CONSISTENCY

C-1 APPARATUS

C-1.1 Palette Knife or Metal Rod

C-1.2 Panels

C-1.2.1 Unless specified otherwise, mild steel panels of size 150 mm × 50 mm × 1.25 mm shall be prepared as prescribed in **2** of IS 101 (Part 1/Sec 3).

C-2 PROCEDURE

C-2.1 Insert a clean metal rod or palette knife into the original container of each component and examine the nature of settling.

C-2.2 Observations

The material shall not cake hard inside the container and shall be in such a condition that stirring easily and after mixing of the two components in the proportion recommended by the manufacturer produces a smooth uniform paint suitable for spraying and also for brushing on steel panels without producing appreciable drag on the brush.

ANNEX D

[*Table* 1, *Sl No.* (xi)]

DETERMINATION OF POT LIFE

D-1 GENERAL

The time taken to reach to end of working life from the original viscosity shall be considered as the pot life of the material.

D-2 PROCEDURE

D-2.1 Condition the components of the coating for 1 h at 27 °C and mix thoroughly immediately in the proper ratio recommended by the manufacturer of the paint. Prepare a sample of approximately 200 ml by volume and fill in a clean closed 500 ml container to be approximately 1 cm of the top. The lid should be loosely placed on the can.

D-2.2 Measure the viscosity initially and record the initial time. Continue measuring the viscosity every h thereafter by any method as prescribed in IS 101 (Part 1/Sec 5).

NOTE — The interval may be shortened, if desired.

D-2.3 Near the end of the coating's working life, the viscosity builds up rapidly. When it appears that the coating may be too viscous to spray, remove a small portion and add the appropriate thinner. If the paint can still be thinned, the end of the working life has not been reached.

D-2.4 Observations

The end of the working life is reached when the paint gels, becomes stringy or cannot be thinned for application. Record the time.

D-3 RESULTS

Report the time taken to reach the end of working life as pot life of the material. The material shall be deemed to have pass this test provided the pot life is found to be within the time as specified in Sl No. xi) of Table 1.

ANNEX E

[*Table* 1, *Sl No.* (xiv)]

ACCELERATED TESTS

E-1 GENERAL

These tests of chemical resistance, are included to assure the customer that the coating contains a sufficiency of cured resin to exhibit the long-term requirements. An air-dried film of the material is immersed in solution of acid, alkali, oil and other solvents for specific periods and examined for any deterioration. The test shall be carried out at a temperature of 27 ± 2 °C unless otherwise specified.

E-2 PREPARATION OF TEST PANELS

Prepare the panels as prescribed in **6.3.3** for carrying out the tests given in **E-4.1** to **E-4.4**. Paint both sides of the panels and protect the edges of the panels by sealing with chlorinated rubber paint. For each reagent prepare separate panel.

E-3 REAGENTS

E-3.1 Sulphuric Acid — Thirty percent solution (*v*/*v*) (*see* IS 266).

E-3.2 Caustic Potash — Thirty percent solution of potassium hydroxide (*see* IS 6831).

E-3.3 Oil — Mineral lubricating oil.

E-3.4 Solvents

E-3.4.1 *Xylene*

E-3.4.1 *Ethanol* (*see* IS 15464).

E-3.4.1 *Acetone (see* IS 170).

E-4 PROCEDURE

Place sufficient amount of each reagent in separate suitable vessel to completely or partially immerse the test panel. Immerse the test panel in an approximately vertical position using suitable supports, if necessary. Cover the container for the duration of the test to minimize the loss of reagent by evaporation or splashing.

E-4.1 Resistance to Acid

Immerse three-fourth of the panel in 30 percent solution of sulphuric acid for 24 h. Remove the panel, wash it thoroughly in fresh running water and allow it to dry for an h. Record the observation.

E-4.2 Resistance to Alkali — Immerse three-fourth of the panel in 30 percent solution of potassium hydroxide for 12 h. Remove the panel, wash it thoroughly in fresh running water, and allow it to dry for 1 h. Record the observation.

E-4.3 Resistance to Oil

Immerse three-fourth of the panel in a mineral lubricating oil, having a viscosity of 18.0 CSE or having a time of flow of approximately 80 s for 50 ml at 60 °C in a No. 1 redwood viscometer, for 24 h. Remove the panel and wipe the excess oil with suitable absorbent cotton, wash it with mineral turpentine and allow drying for 30 min. Record the observation.

E-4.4 Resistance to Solvents

This test is spot test against different solvents. Test one panel each for resistance to xylene, ethanol and acetone respectively. Place the test panel in a horizontal position. Take clean white sterilized cotton and soak it in the solvent and place it on the painted panel without squeezing the cotton. Immediately cover the soaked cotton with a suitable watch glass and leave it for 3 h. Remove the watch glass and the soaked cotton, wipe the area with clean dry cotton. Record the observation immediately.

E-5 RESULTS

The panels after each test shall not show any signs of blistering, wrinkling and lifting. There will be no appreciable change in colour and appearance.

ANNEX F

[*Table* 1, *Sl No.* (xv)]

DURABILITY TEST

F-1 GENERAL

Prepare both sides of the panels as prescribed in **6.3.3** for carrying out normal outdoor exposure test as well as accelerated weathering test.

F-2 NORMAL OUTDOOR EXPOSURE TEST

F-2.1 Expose the test panels in the open in duplicate at an angle of 45° facing south. The duration of test shall be for a period of 12 month. The test shall be started from any month in a calendar year. Examine the condition of the exposed films at monthly intervals for the first quarter and thereafter quarterly for the rest of the period for the following characteristics:

a) Colour;
b) Checking, cracking and flaking;
c) Chalking;
d) Spotting; and
e) Blistering.

F-2.2 For the above examinations, wash the right hand half of the surface of the two test panels with 5 percent caustic soda solution followed by 5 percent hydrochloric acid solution and subsequent thorough rinsing with water. Wipe the panel with a clean soft cloth or chamois leather (*see* IS 1017) without causing burnishing. Adequate time for cooling of the panels to room temperature shall be allowed prior to washing examine the same half of the test panels at each examination. Examine the same half of the test panels at each examination. As an aid in the examination, a magnifying glass may be used, but the valuation shall be based on an assessment with the unaided eye. At the end of the stipulated period for durability test, examine the two halves of the test panels. The sample shall be considered satisfactory if the material surface underneath as well as condition of the film in both the halves, the one washed periodically as well as the one washed only for the final examination is satisfactory. Stray film failure, due to extraneous causes other than climate, shall be ignored.

F-2.3 Evaluation of Exposed Films

The requirements of this test shall be taken to have been satisfied if performance in respect of the film characteristics [Sl No. (ii) and (iii) only] as given in **C-4.3** of IS 8662 is within the limits specified in Table 1.

F-2.4 Protection Against Corrosion

After the exposure of the film is discontinued, examine for corrosion of the metal surface of the panel underneath by removing film at 5 different places, one in the centre and one each at 4 different places near the 4 corners about 50 mm away from either edge. The paint film shall be removed by solvent type paint remover. When the film is softened by the paint remover, it shall be removed by gently rubbing with cotton swab or waste jute taking care to remove adhering film of primer and/or undercoating. After removal of the film, the exposed metal shall be covered by thick mineral oil or petroleum jelly. Localized corrosion and/or rust spots shall not constitute a cause of failure. To satisfy the requirements of this standard, the metal surface shall be otherwise free from corrosion.

F-3 ACCELERATED WEATHERING TEST

This test shall be done in an artificial weathering apparatus either in Xenon arc type (with rotating day/night device) or in UV condensation type apparatus for uniform and controlled exposure to the effects of heat, light and water.

F-3.1 Accelerated Weathering Apparatus — An artificial weathering apparatus of the xenon arc type (with rotating day/night device).

F-3.1.1 *Procedure*

Commonly used cycles and test conditions for Xenon arc apparatus are given below:

a) Black panel temperature 63 ± 3 °C;
b) Exposure in light for 102 min and intermittent exposure to water spray for 18 min and continue this exposure to light and spray till the specified test period; and
c) Irradiance 0.50 ± 0.01 W/m^2/nm at 340 nm approx wavelength.

Carry out the test for 1 000 h. The test panel should be thoroughly cleaned with running water followed by wiping using wet soft cloth or chamois leather (*see* IS 1017) with light pressure (to avoid burnishing) till the surface is visibly cleaned of debris.

F-3.1.2 *Evaluation of Exposed Films*

The requirements of this test shall be taken to have been satisfied if performance in respect of the film characteristics [Sl Nos. (ii) and (iii) only] as noted in

C–4.3 of IS 8662 is within the limits specified in Table 1.

F-3.2 UV Condensation Type Apparatus — This apparatus may be used as an alternative test to **F-3.1**.

F-3.2.1 *Procedure*

Commonly used cycles and test conditions for UV condensation type apparatus are given below:

a) Lamp Type Fluorescent UV B-313.
b) 4 h UV at 50 ± 1 °C Black panel temperature.
c) 4 h condensation at 45 ± 1 °C Black panel temperature.
d) Approx. Wavelength 310 nm.
e) Irradiance 0.71 W/m^2/nm.

Carry out the test for 500 h. The test panel should be thoroughly cleaned with running water followed by wiping using wet soft cloth or chamois leather (*see* IS 1017) with light pressure (to avoid burnishing) till the surface is visibly cleaned of debris.

F-3.2.2 The requirements of this test shall be taken to have been satisfied if performance in respect of the film characteristics as noted in **C–4.3** of IS 8662 [Sl No. (ii) and (iii) only] is within the limits specified in Table 1.

NOTES

1 As a precaution against inadvertent accidents, it is recommended that the outdoor exposure test (*see* **F-2**) and the accelerated weathering test (*see* **E)** are carried out in duplicate.

2 For details of method of tests for both xenon arc and UV apparatus follow **5** and **6** of IS 101 (Part 6/Sec5).

ANNEX G

HEALTH HAZARDS AND SAFETY MEASURES

(*Foreword*)

Use of polyurethane paints generally presents a two-fold potential hazard, toxic hazards and fire hazards.

Toxic effects though the lungs and the skin occur frequently in the industrial usage of paints. The best guide of comparative values of ingestion toxicity is the LD 50 value. It refers to the lethal doses of toxic substance which can kill 50 percent of one class of animal in test. The LD 50 value for polyisocyanates is much lower when compared to the LD 50 value of cyanides. Another guide of comparative values of inhalation is the threshold limit value (TLV).

The TLV for monomeric di-isocyanates has been fixed up at 0.02 ppm. Therefore, spraying of polyurethane paints calls for safety precautions in the form of proper ventilation, proper exhaust facilities and hand-gloves for the spray painters. However, it would be an ideal painting practice to go in for proper spray booth.

As far as fire hazards are concerned, all solvents based paints are known for their fire-risks. This can be eliminated by providing good ventilation so as to avoid vapour air mixture which is flammable and also by not exposing the paint vapors to sources of static electricity, sparks or flames.

The polyurethane coatings are as safe to handle as any other solvent based paints provided general hygiene principals are followed.

ANNEX H

(*Foreword*)

COMMITTEE COMPOSITION

Paints, Varnishes and Related Products Sectional Committee, CHD 20

Organization	*Representative(s)*
National Test House, Kolkata	Dr Sunil Kumar Saha (***Chairman***)
Akzo Nobel Coatings India Pvt Ltd, Bengaluru	Dr T. Kanakaraju
Asian Paints Ltd, Mumbai	Dr B. P. Mallik
Berger Paints India Ltd, Howrah	Dr B. Bera
Bharat Heavy Electricals Ltd, Tiruchirapalli	Shri L. Gragori
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Ministry of Defence, Department of Standardization, New Delhi	Shri S. K. Kaibarta Shri V. K. Chhabra (*Alternate*)
Ministry of Industry, DIPP, New Delhi	Shri N. C. Tiwari
National Test House (ER), Kolkata	Shrimati Ratna De Sarkar
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